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**IOWA STATE UNIVERSITY**  
Institute for Transportation

## Snow and ice control 101

Winter is just around the corner, and local agencies should start preparing now for what is sure to be a wet, white, and slippery start to the season. To remove snow and ice from roads, you can use a combination of strategies: anti-icing and deicing, plowing, and abrasives.

### Anti-icing and deicing

Anti-icing is a proactive approach in which chemicals are applied to the pavement before, or at the very beginning of, a storm. The chemicals create a barrier layer that helps prevent snow and ice from bonding to the pavement surface.

Deicing is a reactive strategy of applying chemicals to the pavement after a storm to break the bond between snow or ice and pavement.

### Chemicals used for anti-icing and deicing

Salt is the most common deicing material and, in the form of brine, the most common anti-icing material used in Iowa. Salt is cost-effective and, in its dry form, can provide rapid anti-skid protection while starting the melting process.

To melt snow and/or ice, salt must be in a liquid solution. The salt dissolves into the solution, lowering the freezing point of water. For effective melting action, there must be enough salt concentrated in the solution to lower the freezing point of water to a temperature that is below the current air temperature.

Salt brine is produced by circulating water

through salt to achieve a desired concentration level of brine. For anti-icing, the brine is spread on the roadway before a storm begins. However, salt brine is only effective at temperatures above 20 degrees F.

For deicing, it has become common to pre-wet salt so that some salt is already in the solution when applied. Wet salt has another advantage: it is less likely to bounce off the road or to be blown off by traffic, thus saving 20 to 30 percent in wasted salt.

Salt can be pre-wet by spraying it as it is loaded into the truck or, with truck-mounted equipment, as it leaves the spreader.

Common chemicals used for pre-wetting salt are liquid calcium chloride, magnesium chloride, and salt brine.

Liquid calcium chloride and magnesium chloride are widely used because they draw moisture from the air and release heat when they dissolve. Calcium chloride has the added advantage of melting snow/ice at lower temperatures—down to 0 degrees F in proper concentrations.

Using salt brine to pre-wet is becoming more common because of its lower cost. But remember, salt brine should only be used for pre-wetting in temperatures above 20 degrees F.

### Applying salt for deicing

On two-lane pavements with low to medium

*Snow and ice control continued on page 3*



Two ways to rid snow and ice from roads include plowing and the use of salt brine.

## Acronyms and Abbreviations in *Technology News*

AASHTO	American Association of State Highway and Transportation Officials
APWA	American Public Works Association
FHWA	Federal Highway Administration
IHRB	Iowa Highway Research Board
InTrans	Institute for Transportation (at ISU)
Iowa DOT	Iowa Department of Transportation
ISU	Iowa State University
LTAP	Local Technical Assistance Program
MUTCD	Manual on Uniform Traffic Control Devices
NACE	National Association of County Engineers
TRB	Transportation Research Board



U.S. Department of Transportation  
Federal Highway Administration



### About LTAP

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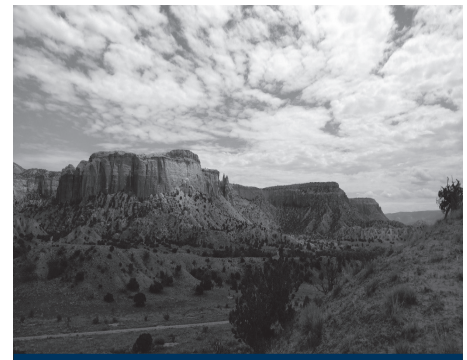


## From the director: The ever-changing and expanding sphere

I made another trip to Santa Fe, New Mexico, in August. I hope this will become an annual pilgrimage for me. If you've been reading these quarterly columns, you already know that New Mexico is one of my favorite places. I find the landscape astonishing, especially in how it changes (see the attached photo). It could look completely different at a different time of the day or if the clouds changed shape or, for that matter, if it rained or the wind blew. On a previous day, in the opposite direction from Santa Fe, I was up in the Sangre de Cristo Mountains surrounded by trees that, except for the terrain, reminded me of home.

My trips to New Mexico let me see first-hand how things change on a near constant basis and better understand how to adjust to those changes, in some cases, to literally survive. I believe that evaluating a situation to determine the best course of action, but also adjusting to things as they change, requires a certain presence as well as flexibility and planning. Bit-by-bit, this is transferred into how I approach things here in Iowa (both at home and work).

While in Santa Fe this year, I had an incredible experience that showed me how the outcome of an activity can be influenced by how we look at and approach it. I was able to see Graham Nash (of Crosby, Stills, & Nash) while I was in town. I knew the name, of course, but not the songs. Ten minutes before the concert was supposed to start, the power in Santa Fe went out. The theater went dark, except for the emergency lights, but the mood was still calm and the energy good. The audience just waited, myself included. Then, an half-hour later, Graham Nash came out with his guitar and one of his band members. They sat down and did an acoustic show (no electricity, microphones, or speakers) under the emergency lights. What could have turned into a pretty unpleasant experience, even if just one person did one thing differently, turned into one of the best concerts I've ever attended. It was pretty special. The actions of each person impacted the experience for everyone.



Rural view of New Mexico

In closing, go out and try to expand what I call your "sphere." Remember that as things change and adjustments are made something good can come about (whether immediately or down the road).

And now the pitch: go to a training, safety session, or workshop not only because you're interested in the subject but because it's something new. In October, the Iowa LTAP Local Roads Safety series is coming to six locations: Waterloo, Fort Dodge, Sioux City, Iowa City, Rathbun Lake, and Council Bluffs. And near the end of October, Iowa LTAP is offering Excavation Safety training at three locations: Denison, Ames, and Iowa City. You may have also seen or heard that we are looking into setting up Mine Safety and Health Administration (MSHA) and Survey Fundamentals classes in the near future. We will keep you informed. We will also be offering a free, basic math class in November for our Roads Scholar program participants.

And don't forget that we've posted the "Oversize/Overweight Permitting in Iowa" and "USGS StreamStats" webinar presentations to our website under the Workshops and Programs/LTAP Workshops tab if you're interested.

See you soon. Have a good fall. ■

Keith

*Snow and ice control continued from page 1*

traffic volumes, apply a windrow of salt in a strip along the centerline. Traffic will move salt off the centerline. The salt brine will move down the pavement cross slope and toward the shoulders, melting snow and ice across the entire road width. This application pattern wastes less salt and quickly gives vehicles clear pavement under at least two wheels.

On multiple-lane pavements with medium to high traffic volumes, apply salt in a pattern that covers the full width of the roadway to provide melting action over the full width of the pavement.

## Plowing

Snow plowing is used to clear snow and loose ice from the road during and after a storm. Plowing can be a challenge in both rural and urban areas. Operators in rural areas face challenges such as blowing and drifting snow and decreased visibility. In urban areas, operators must deal with parked cars, narrow streets, and cul-de-sacs.

To minimize dilution and waste of deicing chemicals, plow immediately before applying chemicals to the road.

## Abrasives

Abrasives provide little to no snow- and ice-melting capability, but they are

most useful in providing traction. The most popular abrasive is sand.

Many agencies in Iowa combine sand with salt as a half-and-half mixture. This mixture helps provide some traction support with some melting capability. In a winter when salt stores may be scarce, reducing the amount of salt used can be a useful strategy.

## Final thoughts

**Know your route:** Snow plow drivers who know their routes well can navigate them more easily and avoid hazards. Review your route before the storm.

**Know traffic volumes:** Traffic volumes can impact the rate of chemical application since traffic can help work salt into the snow/ice and aid the melting process. Agencies can use a lower rate of application with higher traffic volumes.

**Know the weather:** Weather conditions can also affect the rate of application. A windy route, for example, will be more prone to rock salt blowing around.

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# Safety tips for snowfighters

Check with your supervisor and follow your agency's policies and procedures.

## Suggested personal safety gear

- Layers of clothes, extra gloves, heavy boots
- Shovel and ice scrapper
- Flashlight for night operations
- Sunglasses for glare
- Water and/or hot liquid

## Advance preparation

- Be properly trained and thoroughly familiar with all equipment and chemicals.
- Make sure an up-to-date first-aid kit, emergency contact information, and handheld radios or cell phones are available in your vehicle.
- Be in good physical condition with adequate rest.
- Perform a pre-trip safety check of truck and equipment. Make sure the vehicle has adequate warning lights in good working order.
- Make a practice run of assigned route to check for obstacles and potential problem areas.
- Know the contact procedures for reporting crashes or equipment breakdowns.

## During operations

- Dress in layers with heavy boots
- Wear highly visible apparel when out of your vehicle
- Plow at appropriate speed
- Watch for pedestrians and other vehicles
- Don't back up without a spotter
- Operate wings carefully
- Make sure warning lights are activated



## Iowa LTAP Mission

To foster a safe, efficient, and environmentally sound transportation system by improving skills and knowledge of local transportation providers through training, technical assistance, and technology transfer, thus improving the quality of life for Iowans.

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# Protecting our bridges for the future

Changes in agriculture operations over the past 50 years are having a dramatic impact on Iowa's roads and bridges. The average size of an Iowa farm has increased to 352 acres in 2003, compared to 237 acres in 1970. Modern agricultural practices have also produced higher yields per acre, which means more grain to haul to market.

In order to increase efficiency, farmers are using larger capacity wagons hauling more bushels per trip to the elevator and using much heavier equipment in their farming operations. This trend is stressing Iowa bridges beyond the current capabilities to maintain them.

Bridges are subject to damage from a combination of the weight on each axle and the spacing of the axles. Iowa laws set maximum gross axle weights of 20,000 pounds for a single axle and 34,000 pounds for a tandem axle on a legal truck.

Most vehicles used as "implements of husbandry" are not required to obey these maximum legal axle weights. Implements of husbandry, considered to be grain carts, tank wagons, or fence-line feeders, are allowed to carry up to 24,000 pounds per axle from February 1 through May 31 and 38,000 pounds per axle from June 1 through January 31, with a maximum gross weight not to exceed 96,000 pounds year-round. These implements of husbandry are restricted to 20,000 pounds per axle and 80,000 pounds gross if they must cross a bridge.

Many bridges in Iowa are over 50 years old. These bridges were designed for lower traffic volumes, smaller vehicles, and lighter loads than are common today.

The weight carried on tractor-semitrailers is

distributed over more axles and a greater length to limit the stress on bridges to acceptable levels. The design of some farm equipment, such as combines and tractors, also results in acceptable stress levels. The vehicles that carry heavy loads on a limited number of axles (one- and two-axle grain carts, grain wagons, and liquid manure tanks) are creating significantly more stress on bridges.

These farm implements are traveling on Iowa's roadways with loads that are much higher than the maximum axle weights permitted for large commercial vehicles. The stress this places on bridges is still excessive for many structures throughout the state. Implements of husbandry are restricted from crossing an embargoed bridge with loads greater than the posted limit, but the stresses caused by these implements of husbandry can be higher than the allowable stress capacity of the bridge even at the posted limit. Bridges are posted according to legal truck loads. Posting signs near bridges for possible implement of husbandry loading is impractical and would likely be too restrictive for commercial vehicles.

Subjecting bridges to vehicles that are heavier than the bridges were designed to carry shortens the service life and can cause both visible and hidden damage. The cumulative effect of the damage caused by these heavy loads will eventually force the roadway jurisdiction owning the bridge to restrict the weight of vehicles using the bridge or, in extreme cases, to close the bridge to all traffic.

Article reprinted with permission from a longer pamphlet produced by the Iowa DOT's Office of Bridges and Structures. ■

### Iowa bridge facts

Number of bridges on county roads.....19,008

Number of embargoed bridges on county roads.....4,787

Number of all bridges in Iowa (total).....24,264

### Axle weight comparisons



Large row crop tractor  
18,000 lbs. Two single axles  
11,000 lbs. front/7,000 lbs. rear



Grain wagon - 775 bu.  
49,000 lbs. Two single axles  
24,500 lbs. each axle



Five-axle truck  
80,000 lbs. Two dual axles/one single axle  
34,000 lbs. duals/  
12,000 lbs. single



Grain cart - 875 bu.  
68,700 lbs. One single axle  
57,000 lbs.



Liquid manure tank  
10,000 gal.  
96,000 lbs. Two dual axles  
70,000 lbs. rear duals  
26,000 lbs. front duals



# Prevent workplace backing accidents

Maintenance garages, equipment yards, and road work zones can be dangerous places. Heavy equipment operates close to workers on foot in areas busy with activity and noise. Unsafe backing maneuvers in these environments can increase the risk of death or injury and cost many thousands of dollars for repair and replacement of damaged equipment.

“Going in reverse is not a natural maneuver because the blind spots, especially on larger vehicles, can be huge,” says Ben Rank, a loss control specialist with Cities and Villages Mutual Insurance Company in Wisconsin. “But sometimes there is no alternative but to back a vehicle.”

Rank says that street and highway departments can prevent workplace backing accidents by following best practices and raising awareness through good training. He emphasizes three key principles for safe backing and offers additional tips.

## Key backing principles

- Avoid the need to back up: Operators should park defensively and leave room to pull away going forward when leaving a job site instead of backing. Another option is to use a route or location that accomplishes the task while moving forward.
- Use a trained spotter: If backing up is the only option, use a spotter with good technique and hand signals. Make sure spotters work from the driver's side, stay visible, watch for obstructions, and communicate with the driver. Establish a consistent standard throughout the agency that all operators and spotters understand.

- Get out and look: When it is necessary to back up and there is no spotter around, Rank recommends the simple GOAL (Get Out And Look) technique. Do a complete 360 of the vehicle and the area around it to assess possible blind spots, distances, height clearance, and the presence of any activity or workers that could interfere with a safe backing operation.

## Additional backing tips

- Position mirrors for clear sightlines before operating the vehicle
- Make sure the backup alarm is working; if it is not or fails during maneuver, use a spotter
- Keep driver's window down to hear and be heard, as well as the passenger window when backing or driving in the vicinity of workers on foot
- Turn off the radio or other distracting devices; give complete attention to the backing operation
- Minimize the number of work activities near moving equipment
- Install signs in work areas that alert employees on foot about the location of moving vehicles
- Don't allow riders in the back during the backing maneuver
- Check for changing conditions in the area if the vehicle is stationary for more than two seconds
- Sound the vehicle horn a designated number of times to signal a backing maneuver to all crew members
- Back slowly, at a walking speed
- Do not back more than 50 to 100 feet before stopping and rechecking the area for a clear zone

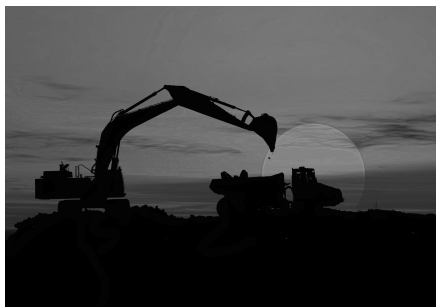
- Follow more stringent guidelines in confined areas and for night work

## Standard operating procedures

Rank recommends that public road agencies incorporate these rules into their standard operating procedures. Training that regularly reinforces safe practices like these also prepares equipment operators, spotters, and all workers to take preventive action.

Technology such as truck-mounted cameras are helping improve safe operation, but Rank cautions against relying on technology alone. Instead, use the above principles and tips to insure a safer, successful backing operation.

Adapted with permission from the Summer 2014 issue of *Crossroads Newsletter*, a newsletter of the Wisconsin Transportation Information Center. ■



The use of heavy equipment in work zones can be dangerous, especially at night, so proper backing principles should always be used.

# Accommodating bicyclists and pedestrians on rural roads

By Lois Chaplin, Circuit Rider, Cornell Local Roads Program

With the increased attention being paid to providing access for pedestrians and bicyclists on our roadways, when and how to safely accommodate their needs is not always easy to determine. However, it can be critical in many areas.

## What are treatment options that are bicycle and pedestrian friendly?

Road shoulders are often a preferred treatment to accommodate bicyclists and pedestrians on rural roads. Sidewalks and bike lanes are treatment alternatives in more urban and suburban environments where there is typically more traffic.

## What purpose do road shoulders serve?

Some low-volume roads were built with little or no shoulders. In some situations, lack of space or certain soil conditions do not allow for a road shoulder. As traffic volumes and speeds increase, however, their value becomes greater.

We commonly list the following as the benefits of shoulders for all road users:

- Allowing for driver error and providing space to make evasive maneuvers
- Increasing the sight distance for through-vehicles and for those entering the roadway
- Providing structural support for the pavement
- Moving water farther from the travel lanes, reducing damage to the base and subgrade, as well as reducing hydroplaning, splash, and spray
- Providing space for maintenance operations
- Providing space for disabled vehicles, mail delivery, and bus stops

In many cases, a simple shoulder can add one more critical benefit:

- Providing space for bicyclists and pedestrians (including those pushing strollers or carts)

Here are some answers to some commonly asked questions about accommodating bicycles and pedestrians along highways.

## What are shoulders made of and how wide should they be?

If a shoulder is intended to be used by pedestrians or bicyclists, it should be paved and a minimum of four feet wide. This improves the safety for those users by helping provide separation between the fast moving motorized traffic and the slower bikes and pedestrians. Faster confident bicyclists may tend to travel in the main lanes, but this is not true for younger or less confident bike riders.

A chip-sealed surface with a relatively thin gravel base may be adequate for many pedestrian and bicycle applications. The structural strength provided in the base should be adequate for the anticipated traffic. Where truck traffic may be expected to drive on or park on the shoulder, the strength should be comparable to the traveled way, with an asphalt or concrete surface.

## Can you mark road shoulders as bike lanes?

The Vehicle and Traffic law definition of a bike lane is:

*A portion of the roadway, which has been designated by striping, signing, and pavement markings for the preferential or exclusive use of bicycles.*

If rural road shoulders are to be used by bicyclists and pedestrians, it is advisable to not mark it as a bike lane. Doing so would pose a safety hazard, implying that bikes and pedestrians would be required (illegally) to share a bike lane. A better choice is to place a sign advising folks to share the road. (The sign can be yellow or fluorescent yellow-green.)



## Can't you just put a separate path along the way and tell bicyclists and pedestrians to go there?

Bicyclists (and in-line skaters) have the legal right to share the road on most public roadways. (They are prohibited on interstate highways, expressways, and some other limited access highways.) Consequently, bicyclists cannot be required to use separate facilities such as a separate pathway. They may choose to use a separate path, if provided. If properly designed and placed in a good location, many bicyclists will use the trail, but if inconvenient, they will just stay on the highway.

## How about designating certain roads as safe bicycling roads?

You don't want to try to label roads as good or bad for bicycling. Describing something as "safe" may lead to a false sense of security in many cases. There are many factors that play into a road's suitability for bicycling. This can include posted speed limits, shoulder characteristics, longitudinal grade of the highway, pavement quality, and amount of traffic. Cyclists may choose different roads at different times depending upon such factors as their skill level and goals for any given trip.

Article adapted with permission from the Fall 2013 issue of *Nuggets and Nibbles*, a newsletter of the Cornell Local Roads Program. ■

# Conference calendar

Date	Event Name	Location	Contact
<b>October 2016</b>			
4-6	APWA Snow Plow Operator Training/Snow Rodeo	Des Moines	Paul Albritton
18	Local Road Safety Workshop	Waterloo	David Veneziano
19	Local Road Safety Workshop	Fort Dodge	David Veneziano
20	Local Road Safety Workshop	Sioux City	David Veneziano
25	Local Road Safety Workshop	Iowa City	David Veneziano
25	Excavation Safety	Denison	Paul Albritton
26	Local Road Safety Workshop	Rathbun Lake	David Veneziano
26	Excavation Safety	Ames	Paul Albritton
27	Local Road Safety Workshop	Council Bluffs	David Veneziano
27	Excavation Safety	Iowa City	Paul Albritton
<b>November 2016</b>			
2	Math Skills	Ames	Paul Albritton

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## Event details and online registration

Watch for details and online registration information, by specific dates and events, on the Iowa LTAP Workshops page, [www.iowaltap.iastate.edu/workshops/ltap-workshops/](http://www.iowaltap.iastate.edu/workshops/ltap-workshops/). ■

# Iowa LTAP Tech Corner—Sound Meter app

## What is it?

Recommended as an auxiliary tool, this free application for Android devices is one of a collection of apps made and distributed by Smart Tools co. The Sound Meter app uses the device's built-in microphone to measure noise volume in decibels (dB). It looks specifically at sound "pressure" levels.

Some examples of sound pressure include the following:

- 20dB : Rustling leaves, ticking watch
- 30dB : Quiet whisper at 3 ft, library
- 40dB : Quiet residential area, park
- 50dB : Quiet office, quiet street
- 60dB : Normal conversation at 3 ft
- 70dB : Busy traffic, phone ringtone
- 80dB : Busy street, alarm clock
- 90dB : Factory machinery at 3 ft

## How does it work?

1. Open the app and discover the level.
2. To save the data, an in-app button allows you to save a screenshot.

Additional features include an easy-to-understand menu, an in-app text- and chart-based reference guide, a black/white toggle used for dimming the phone screen to save battery, and efficient play/pause modes.

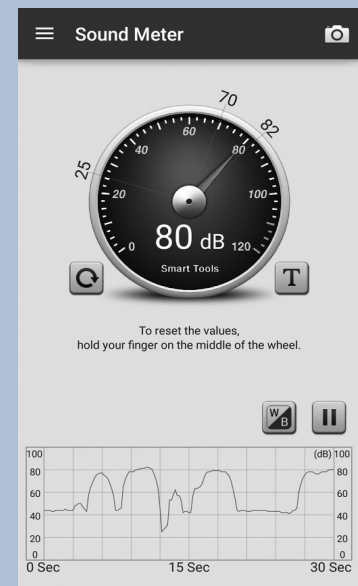
Remember, most microphones are aligned to only pick up human voices (40–60dB). Due to this hardware limitation, additional optimization of the phone's calibration menu may be necessary. Most devices will measure at least 80dB: Galaxy S3-S5 (81–84dB), HTC Desire HD (85dB), Galaxy Note (81–91dB). And most Motorola and Amazon Fire devices can measure above 90dB (approx. 96dB).

It is recommended that you calibrate the app using either an actual sound level meter or in a very quiet room (30–35dB) to ensure optimum accuracy.

## Where can I get it?

Use the QR code here or visit Google Play (search for "Sound Meter") to download the free app today.

Information about and links to the app are also available at [androidboy1.blogspot.com/2015/08/sound-meter-v16.html](http://androidboy1.blogspot.com/2015/08/sound-meter-v16.html), along with a link to a demo video for the Sound Meter app. ■



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